FISHERY MANAGEMENT INVESTIGATIONS

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ANDERSON RANCH RESERVOIR KOKANEE MONITORING

ABSTRACT

We completed a kokanee *Oncorhynchus nerka* abundance estimate on Anderson Ranch Reservoir using standard trawl techniques. We completed 20 transects with a total catch of 216 kokanee. Kokanee catch per trawl (95% CI) averaged 11 ± 2 and ranged from 0 - 42 fish. Kokanee lengths ranged from 40 mm to 360 mm.

Total abundance of kokanee among all strata and age groups was estimated at 243,454 fish, representing a density of 167 fish/ha. Reservoir densities of age-0, -1, -2, and -3 kokanee in 2014 were estimated at 76, 11, 71 and 10 fish/ha, respectively. The reservoir standing crop estimate for all age groups was 22 kg/ha.

Kokanee densities (fish/ha) across all age classes in 2014 were some of the lowest recorded in past surveys. This low density may have resulted from an extremely low drawdown and associated high entrainment of young of the year kokanee in 2013. Angling success in the next few years may fall below management objectives described in the 2013-2018 Fisheries Management Plan (catch rates of one kokanee an hour with mean lengths of 305-356 mm). We expect fish size in the creel to be at or above the preferred 305 mm (12 inch) TL, but catch rates may fall below one kokanee per hour.

Fall Chinook Salmon *Oncorhynchus tshawytscha* were reintroduced in 2013. The reintroduction was not intended to control kokanee numbers, but Chinook Salmon were expected to thrive in the fishery where juvenile kokanee production was high. Entrainment and predation pressure may further reduce kokanee densities. Relatively low numbers of young-of-the-year and Age-1 kokanee could mean slower than expected growth for Chinook Salmon.

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INTRODUCTION

Anderson Ranch Reservoir anglers primarily target kokanee *Oncorhynchus nerka*, Rainbow Trout *Oncorhynchus mykiss*, Smallmouth Bass *Micropterus dolomieu*, and Yellow Perch *Perca flavescens*. Bull Trout *Salvelinus confluentus* and several nongame fish species are also present. Kokanee are managed for a harvest fishery with a daily bag limit of 25 fish/d and a possession limit of 75 fish. Trends in reservoir kokanee abundance have been monitored on an annual basis using trawling techniques since 1987.

We continued to monitor the abundance of kokanee in Anderson Ranch Reservoir in 2014. These data will be used to describe age class composition and abundance, develop fishing forecasts, and to predict high escapement years where escapement control measures could be implemented to reduce density-dependent competition.

STUDY SITE

Anderson Ranch Reservoir is a Bureau of Reclamation (BOR) operated impoundment on the South Fork Boise River in Elmore County, Idaho (Figure 1). Maximum reservoir storage capacity is 60,833 m^3, of which 3,575 m^3 is considered dead storage (USGS 1996). Transects are identified in Ryan et al. 2008.

OBJECTIVE

The objective of this survey was to generate a cohort-specific abundance estimate. These data are part of a long-term monitoring program used to evaluate how reservoir kokanee densities correlate with angler harvest and harvest goals identified in 2013-2018 Fisheries Management Plan (IDFG 2013).

METHODS

Trends in Anderson Ranch Reservoir kokanee abundance were monitored using nighttime midwater trawling techniques described by Rieman (1992). Sample dates were on or around a new moon period in late July, just prior to the spawn. Sampling followed the historical protocol (Partridge and Warren 1995) which includes seven transect tows per strata resulting in a total sample of 21 trawls. Trawls were completed using a 4.46 m^2 framed trawl net pulled at approximately 1.59 m/s. Net hauls were made on three-minute intervals per depth strata (i.e. steps). Net hauls were made at three meter depth intervals from 7.3-22.0 m.

Kokanee sampled during trawl efforts were measured to TL (TL, mm) and weighed (g). Otoliths and scales were collected to estimate kokanee ages from a nonrandom representative TL groups. Otoliths were collected from at least 10 fish within each 1-cm length group for kokanee > 100 mm. Kokanee less than 100 mm were assigned to the young-of-year age class and all others were aged from otoliths. All otoliths were aged, and 25% of the sample were randomly selected and aged again for validation.

Scales were used to estimate age only if otoliths were unsuitable. Otoliths were viewed whole and/or sagittally from cut otoliths. Otoliths were examined using a dissecting microscope under 10X – 40X magnification. Scales were placed between two glass slides and viewed with a microfiche reader.

Abundance, relative density, and standing crop were estimated by age group using an EXCEL spreadsheet developed by IDFG fisheries research personnel (Bill Harryman, IDFG, personal communication). Kokanee densities were calculated using reservoir surface area at the time of the sampling, as determined by reservoir water elevation. Water elevation was taken from the States Department of Interior, Bureau of Reclamation website (www.usbr.gov). Area was estimated from a rule curve generated from measured area within elevation contours.

RESULTS

Anderson Ranch Reservoir kokanee were sampled on the nights of July 24 and 25, 2014. The reservoir elevation on the sample dates was approximately 1,230 m and maximum storage (i.e. full pool) occurs at 1,279 m. Surface area at the time of sampling was estimated at 1,458 ha. In all, 21 trawls were completed resulting in a catch of 209 kokanee. Kokanee catch per trawl averaged 10 ± 3 (95% CI) and ranged from 0 - 27 fish. Kokanee lengths ranged from 40 - 360 mm (Figure 2).

Total abundance of kokanee among all strata and age groups was estimated at 243,454 fish, representing a density of 167 fish/ha. Reservoir densities of age-0, -1, -2, and -3 kokanee in 2014 were estimated at 76, 11, 71 and 10 fish/ha, respectively. The standing crop estimate including all strata and age groups, was 21 kg/ha (Table 1).

A subsample of kokanee was collected and aged (n = 110). The average length within the subsample was 283 mm ± 18 (95% CI), with a range from 173 – 325 mm. Mean length at age in 2014 was similar to those estimated in 2011, but greater than in 2012 (Figure 3). No sampling of kokanee occurred in 2013 for comparison.

DISCUSSION

Kokanee densities across all age classes in 2014 were some of the lowest recorded in our standard surveys (Table 2). Low numbers of kokanee could be related to extremely low reservoir drawdown which exacerbated entrainment of young of the year kokanee in 2013. Angler catch rates in the next few years may fall below management objectives described in the 2013-2018 Fisheries Management Plan (IDFG 2013). The fishery goal is to provide catch rates of one kokanee per hour with mean lengths of 305 - 356 mm. We expect fish size in the creel to be at or above the preferred 305 mm (12 inch) TL. However, catch rates may fall below one kokanee per hour due to low densities.

Chinook Salmon *Oncorhynchus tshawytscha* were reintroduced in 2013. Chinook Salmon are not intended to control kokanee numbers, but are expected to thrive in the fishery where juvenile kokanee production is typically high and provide a trophy component to the reservoir fishery. Combined with entrainment, predation pressure may further reduce kokanee densities. Relatively low numbers of young-of-the-year and age-1 kokanee may also mean slower than expected growth for Chinook Salmon.

Kokanee abundance trends and production potential in Anderson Ranch Reservoir are primarily affected by factors over which the Department has little control. Variables such as reservoir storage levels, spawning habitat conditions, and winter survival of deposited eggs are most likely driving kokanee populations in Anderson Ranch Reservoir. However, the Department can use hatchery stocking, adjust angler harvest, and regulate adult escapement to attempt to manage kokanee abundance. Given the relatively low young-of-the-year densities documented in 2014, the Department should evaluate spawning habitat in the South Fork Boise River. If natural kokanee production doesn't seem adequate to sustain the reservoir fishery, hatchery supplementation should be considered in 2015.

RECOMMENDATIONS

1. Evaluate South Fork Boise River spawning habitat potential for natural kokanee production. Request hatchery kokanee supplementation should the habitat appear to be limited.
2. Continue to reduce stocking densities of Chinook Salmon until YOY and age-1 kokanee are at higher densities.

BRUNEAU DUNES PONDS CREEL SURVEY

ABSTRACT

An access-access creel survey of the Bruneau Dunes State Park Ponds was completed from May 4 through October 31, 2014 to estimate angler use, catch rates, and harvest in both ponds. A total of 239 anglers were interviewed, with the majority of the surveyed anglers having completed their fishing trip (*n* = 201) with an additional 38 incomplete trips. The average trip length for completed trips was 5 ± 2 hours (95% CI). Anglers applied 3,177 ± 458 (95% CI) hrs of angling effort in the upper pond. Anglers caught a combined 16,986 ± 5,972 Largemouth Bass and Bluegill. The average combined Largemouth Bass and Bluegill catch rates were 5.2 fish/hr. In the larger lower pond, anglers applied 476 ± 193 hrs of angling effort. Surveyed anglers caught no fish, which precluded catch and harvest estimates, but suggested fishing quality was poor. The bulk of the effort in the Bruneau Dunes fishery is on Pond #1, the smaller, upper pond. The Bruneau Sand Dunes State Park fishery receives relatively high angling pressure. However, fishing in the larger, lower pond is poor. Most fishing effort was documented during the months of May and June. Overall effort in the smaller Pond #1 alone was over six times the total overall effort in the larger Pond #2 for the total May-July months combined. Common Carp were removed from Pond #1, but still remain in Pond #2, and are likely the main cause of poor bass and Bluegill fishing in the larger pond. We recommend removing Common Carp from Pond #2 as the first step to improving the warmwater fishery there. These ponds are a popular warmwater fishery, and angler use at the Bruneau Dunes fishery could be increase greatly by restoring the fishery in the larger pond. Additionally, costs associated with pumping might be reduced if water management were re-evaluated to determine optimum pumping volume and timing to increase water efficiency.

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INTRODUCTION

The Bruneau Sand Dunes ponds are located within the Bruneau Dunes State Park, approximately 25 km south of Mountain Home, Idaho. Several ponds developed in the early 1950s after ground water levels rose as a result of flood irrigation on nearby agricultural lands. A change to sprinkler irrigation on essentially all of the nearby farms to conserve water lowered the ground water level enough to drop the pond water levels by an average of 1.3 m, thus creating only two adjacent ponds. A pump was installed and put into operation to bring Snake River water into Pond #1 (northeast pond) beginning in the spring of 1987. This pumping system included a 300 m long filter pond adjacent to Pond #1. Pond #1 (upper northeast pond) is estimated to be 12 ha in surface area, while Pond #2 (lower pond) is estimated to be 32 ha in surface area at current water management levels (Partridge and Warren 1995). Water flows directly from the filter pond through a gate into Pond #1, where it then flows through a vertical metal culvert into Pond #2.

The fishery in both ponds is managed for Largemouth Bass *Micropterus salmoides, and* Bluegill *Lepomis macrochirus.* There is currently a two-bass, 20-inch (508 mm) minimum length limit for Largemouth Bass on both ponds. There is no size or bag limit restrictions for Bluegill. Over time, the lower pond has become overrun with Common Carp *Cyprinus carpio*. As a result of the deleterious effects of Common Carp, the Largemouth Bass and Bluegill biomass in the large pond has declined significantly.

STUDY SITE

The Bruneau Sand Dunes Ponds are two ponds located at the base of the large sand dune in Bruneau Sand Dunes State Park (Figure 4). The ponds lie at an elevation of 754 msl.

OBJECTIVE

A creel survey of the Bruneau Dunes Ponds was completed in 2014 to estimate angler use, catch rates, and harvest in both ponds. Results from this survey will be used to evaluate the cost/benefit value of the fishery. Understanding angler effort on these ponds will help the Department determine whether this annual cost is warranted. Additionally, the ultimate goal to optimize the timing and amount of water pumping and restoring the warmwater fishery should be considered in the cost/benefit analysis.

METHODS

An access-access creel was conducted from May 4 to July 31, 2014. The fishery was scheduled to be surveyed on three randomly selected weekdays and two weekend days in each 14-day period. Day periods were stratified by 4-hour shifts: early, middle, and late. Effort estimates were generated based on mean angler counts and average daylight hours during the creel period (average = 12 hrs).

Two angler counts were conducted on each survey day and interviews were completed between counts. Clerks counted individual shoreline anglers as well as boat or float tube anglers. During interviews, anglers were asked to report their residency status, hours fished, catch, harvest, gear type, angling methods and whether their trip was completed. If the trip was not completed, anglers were given a postcard with a unique ID number to be returned either by mail, or in a drop box located at the fishery. Postcard data with completed trip information were then correlated to the individual angler, previously recorded as an incomplete trip, and the angler information was updated. Only completed trips were used to generate estimates of catch and harvest.

Data were analyzed using techniques described in Pollock et al. (1994). This data analysis takes raw interview (effort, harvest, catch) and count data, converts it to average/day, and then extrapolates those averages to all days within the creel period.

To estimate pumping costs, we examined electrical bills for the pump station across 2014. We summed up billing charges for an entire calendar year, and confirmed the pumping schedule based on kilowatt-hours used during each month.

RESULTS

A total of 239 anglers were interviewed during the census period. The majority of the surveyed anglers had completed their fishing trip (complete = 201, incomplete = 38). The average trip length for anglers with completed trips was 5 ± 2 hours (95% CI).

We estimated 3,177 ± 458 (95% CI) hours of angling effort in Pond #1 (upper pond, Table 3). Anglers caught a combined 16,986 ± 5,972 Largemouth Bass and Bluegill (Table 4). Catch composition was 75% Largemouth Bass and 25% Bluegill, of which approximately 43% of the Bluegill were harvested. No harvested Largemouth Bass were observed during the survey. The average combined Largemouth Bass and Bluegill catch rates were 5.2 fish/hr.

In Pond #2 (larger lower pond), we estimated 476 ± 193 hrs of angling effort (Table 5). The anglers surveyed caught no fish, which precluded catch and harvest estimates (Table 6), but suggests that fishing was poor.

Reviewing electrical bills for 2014 indicated that the ponds are receiving pumped water from the Snake River for about nine months per year. Pumping begins in October and runs through May the following year. The average monthly cost to run the pump was $868/mo, with an annual total cost to pump water in 2014 of approximately $10,400. The monthly average pumping cost included months when the pump was off, when only a small maintenance fee of $20-30 was billed.

DISCUSSION

The bulk of the effort in the Bruneau dunes fishery is on Pond #1. The Bruneau Sand Dunes State Park fishery receives relatively high pressure. However, fishing in the larger Pond #2 was poor. Most fishing effort was documented during the months of May and June. Overall effort in Pond #1 alone was over six times (6.59) the total overall effort in the larger Pond #2 for the total May-July months combined.

Given the annual pumping cost of around $10,400, there is a clear incentive to improve angling effort. The Bruneau Dunes ponds are a very popular fishery for anglers from both the Treasure Valley and Magic Valley metro areas. The ponds have the potential to provide excellent bass/Bluegill fisheries in a small non-motorized setting, which is uncommon in the area. The cost/benefit value of the Bruneau Dunes fishery would greatly improve by restoring the warmwater fishery in the larger Pond #2 by eliminating Common Carp. This would most likely require chemically treating the pond with rotenone, and then restocking with bass and Bluegill to rebuild the fishery. In addition, we recommend closer examination of pumping schedules and volume in case efficiencies might be found to reduce pumping cost. Costs might be reduced if water management were evaluated to determine if nine months of continuous pumping is necessary. Perhaps pumping could be scheduled for a few hours a day, or weekly on/off periods to cycle the pump and save energy, while monitoring water levels in the ponds.

RECOMMENDATIONS

1. Examine current water management practices to gain a better idea of the pond's hydrology and coordinate with Idaho State Parks to evaluate whether pumping can be more efficient and still achieve fishery recharge.

2. Coordinate with Idaho State Parks to chemically remove Common Carp from Pond #2.

3. Aggressively reintroduce Largemouth Bass and Bluegill to rebuild the fishery in Pond #2.

CAREY LAKE LARGEMOUTH BASS ASSESSMENT

ABSTRACT

Largemouth Bass monitoring was conducted at Carey Lake in 2014. A total of 100 Largemouth Bass were collected among all locations. CPUE was 80 fish/h(± 26; 80% CI), with 5 units of sampling effort. Mean TL of Largemouth Bass was 162 mm ± 11 (90% CI), and ranged from 65 - 320 mm. Largemouth Bass weight ranged from 3 – 393 g, and the mean relative weight (W_r) was 102 (± 3; 90% CI). Mean relative weight suggests Largemouth Bass sampled in 2014 were in good condition. Proportional stock density (PSD) was 18. A subsample of Largemouth Bass was aged (*n* = 46). We documented four age classes. Maximum age of fish was four years old (TL = 320 mm), with very few fish present above the legal minimum size. Annual mortality (ages 1 - 4) was 26%. Further evaluations should estimate anglers harvest and consider habitat improvement to increase Largemouth Bass longevity and improve the size structure.

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INTRODUCTION

Carey Lake is located on a state Wildlife Management Area (WMA) 0.6 km east of the town of Carey in Blaine County, Idaho (Figure 5). Carey Lake is situated at an elevation of 1,452 m and has a maximum surface area of 148 hectares. Most of the lake is shallow and marsh-like, but deeper areas exist (4.5 - 5.5 m) due to dragline operations conducted in August 1977. Carey Lake supports populations of Largemouth Bass, Bluegill, Yellow Perch and Brown Bullhead *Ameiurus nebulosus*. Largemouth Bass and Bluegill were first planted in the lake around 1949. Supplemental stockings of adult Largemouth Bass and Bluegill were made periodically between 1965 and 1975. These species supported a popular fishery for many years. Yellow Perch (perch) were illegally introduced into Carey Lake around 1973 and have since become the dominant species of the fish community. Angling for perch in the winter through early summer period has increased in popularity. Drought conditions (e.g. 1977) and numerous winterkills (1973 to 1985) have in some instances almost completely eliminated fish populations from Carey Lake.

Carey Lake has been subject to periodic drought conditions over the past five years which likely impacted the resident fishery. The purpose of this sampling was to evaluate the existing Largemouth Bass fishery in Carey Lake, establish long-term monitoring data, describe bass population health, and to address potential fishing regulation proposals across all Region 4 bass fisheries.

OBJECTIVE

The objective of this 2014 sampling effort was to characterize Largemouth Bass catch per unit effort (CPUE), growth (length at age), condition (W_r), and size structure (PSD) at Carey Lake. These metrics would be used to compare the Largemouth Bass population among years and other Idaho bass fisheries.

METHODS

Bass monitoring is a technique used to monitor Largemouth and Smallmouth Bass populations within the Magic Valley Region. This standardized survey technique provides data for the evaluation of relative abundance (CPUE), stock structure, fish condition (W_r), and fish growth (length at age).

Largemouth Bass monitoring is conducted in the spring with water temperatures between 15 and 24^o C when Largemouth Bass are known to spawn (Heidinger 1975). The bass populations are surveyed at night using boat electrofishing gear with two bow netters targeting only bass (Appendix B). Each electrofishing sample (effort unit) consists of 15 minutes of shocking effort (power on) at randomly chosen sample sites throughout the lake.

Relative abundance was measured as average catch per unit effort (fish/hr). Sample size goals for electrofishing units are based on the variance around the mean catch/effort unit and power analysis. The minimum sampling effort is determined in situ and is dependent upon catch/unit effort variation. While in the field, a sample size estimator incorporated into a PDA (Personal Digital Assistant – i.e. electronic data device) provides real-time estimates of the mean catch/unit effort, the associated precision of that estimate, and estimated sampling units needed to achieve a desired precision (PDA software: Data Plus Solutions Software©, Cohen 1988). Ideally, sampling continues until the variation around the mean catch/unit effort achieves an 80%

confidence (t-value = 1.26). However, high variation among sampling units sometimes may preclude achieving the desired precision and sampling concludes when time becomes limited.

All Largemouth Bass collected were measured for TL (TL, mm) and weighed (g). Otoliths were collected from up to 5 fish in each cm length group. Otoliths were prepared for age estimation by breaking the otolith centrally, burning or Browning the broken edge with an alcohol burner, and viewing the otolith with a dissecting microscope at 30X – 40X. Otoliths were coated with mineral oil to improve viewing clarity (Devries 1996). Mean length-at-age was calculated from the sub-sample of fish. Fish growth was evaluated from the mean-length-at-age summary using FAST software (Fisheries Analysis and Simulation Tools, Version 2.1©).

Stock structure and condition indices were generated in FAST software. Proportional stock density (PSD) was calculated to index the Largemouth Bass population stock structure (Anderson and Neuman 1996). Relative weights were calculated in EXCEL© software and are reported as the mean W_r of individual fish from the catch.

RESULTS

Sampling occurred on June 12, 2014. Five units of effort were completed; locations are described in Appendix A. A total of 100 Largemouth Bass were collected among all sample locations. Catch per unit effort (80% CI) was 80 fish/h (± 26) fish/hr. The mean total Largemouth Bass length was 162 mm (± 11; 90% CI).TL of sampled fish ranged from 100-320 mm (Figure 6) and weight ranged from 13 - 393 g. Mean relative weight was 102 (± 3; 90% CI; Figure 8). Proportional stock density was 18, while the incremental stock densities for RSD-Q and RSD-P were 90, and 10, respectively (Table 6).

A subsample of Largemouth Bass were aged (*n* = 47). We documented four age classes, with a maximum age of four years old. Length at age data indicate that Largemouth Bass require approximately 4 years to attain 320 mm TL (Figure 7).

DISCUSSION

Overall, the Largemouth Bass fishery in Carey Lake appears to fluctuate substantially. In the past three sampling efforts, the CPUE ranged from 34 - 84 fish/hr, and PSD has ranged from 7 - 22. However, RSD(S-Q) and the maximum age have been fairly consistent. Based on the data collected to date, the abundance and size structure of Largemouth Bass varies over time. However, it is surprising that very few fish were collected over 305 mm (the minimum legal length limit), and no fish were collected over age-4. This is unexpected given that length-at-age data suggest bass reach legal length (305 mm) age age-4, which is a full year sooner than most bass populations across Idaho, suggesting growth rates are above average.

Despite fast growth, Largemouth Bass do not appear to persist past age-4, which is substantially lower than other comparable fisheries in the Magic Valley Region (Table 6). Based on length-at-age data collected in years past (Stanton et al. 2010), Largemouth Bass drop out of the population when they reach just over 300 mm TL (Figure 6), corresponding to the minimum legal limit for harvest. These results differ from other Regional waters where maximum ages of Largemouth Bass range between 6 - 10 years (Table 6). Angler harvest could be truncating the size distribution of bass at Carey Lake, especially given the above-average growth rates we found. While no creel data are available for this fishery, conservation officers indicate the fishery receives very low angling pressure with most harvest occurring in the spring and winter months. Like most warmwater fisheries, angler effort is observed to be associated with Largemouth Bass and Bluegill spawn, but before aquatic vegetation becomes overabundant. It is possible anglers are very efficient at catching and harvesting spawning-sized Largemouth Bass during this time, thus limiting the number of older and larger sized bass. Further evaluations of Carey Lake should collect angler use and exploitation data to evaluate whether harvest is limiting this fishery.

RECOMMENDATIONS

1. Use the “tag-you’re-it” t-bar anchor tags to collect angler use and exploitation data to determine if harvest is limiting the fishery.

HAGERMAN WILDLIFE MANAGEMENT AREA PONDS

ABSTRACT

The objective of this study was to (1) eradicate Common Carp from Anderson Pond 4, and West Hwy Pond, and (2) re-establish a Largemouth Bass/Bluegill fishery in Oster ponds 2-5. Prior to the application of rotenone, Largemouth Bass and Bluegill in the ponds were salvaged with electrofishing and unbaited trap nets. Approximately 385 Largemouth Bass and 7,900 Bluegill were captured and transported from the West Highway Pond and Anderson Pond 4 and released into the Goose Pond prior to the rotenone. The Department followed rotenone application guidelines as outlined in the Planning and Standard Operating Procedures for the Use of Rotenone in Fish Management (Finlayson et al. 2000). Prenfish™ Toxicant (5.0 % rotenone) was the product selected to complete the fishery restoration. We adhered to label prescribed mixing and application requirements. The ponds were treated at a label prescribed rate of 5 ppm described for use for Common Carp in an organic rich environment. Fish toxicant was applied with back pack pesticide application sprayers, an ATV pesticide application setup (2.5 m boom) retrofitted for a boat, and by a shoreline based water pump (output of .0003 m^3/s) that drew from a shoreline-based tank of premixed rotenone solution. The shoreline based solution was delivered by boat and from the shore through approximately 100 m of garden hose.

Renovation of West Highway Pond and Anderson Pond 4 was conducted on August 18 and 27, 2014, respectively. Treatment was initiated at approximately 0900 h and completed by 1430 h that same day. We cumulatively applied 314 L of product into the two impoundments. Lethal concentrations were confirmed within 12 hours of initial application. Reintroduction of Largemouth Bass was completed in Oster Lakes 2-5 on the HWMA in the spring of 2014. Largemouth Bass were restocked at a rate of 25 bass per surface acre.

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INTRODUCTION

The Hagerman Wildlife Management Area (HWMA) includes the Hagerman State Fish Hatchery and supports many small ponds which are stocked annually with hatchery Rainbow Trout. The Oster Lakes are located on the HWMA and are popular fisheries for trout, Largemouth Bass, and Bluegill. Hagerman Wildlife Management Area has a series of ponds which are fed primarily by Riley Creek and Tucker Springs. Most of the ponds to the north of the state fish hatchery are managed primarily for warmwater fish, while the ponds to the south are managed as put-and-take trout fisheries. The Riley Creek Impoundment is the only pond north of the hatchery that is regularly stocked with trout. Because of the WMA's importance as a waterfowl resting area during the winter and nesting area during the spring, the fishing season on the Anderson Ponds, Goose Pond, and West Pond is open from July 1 to October 31. All other waters on the WMA including the Oster Ponds are open from March 1 to October 31, except Riley Creek upstream of the state fish hatchery diversion is open to fishing year-round.

Sixteen ponds are located at HWMA and include: 6-Oster Lakes, 4-Anderson Ponds, 2-Bass Ponds, 1-Goose Pond, 1-Riley Creek Impoundment, 1-Hatchery Settling Pond and 1-West Pond. Spring water flows through HWMA and is 14 degrees C. HWMA is located near several Magic Valley communities. As a result, the area provides opportunities to thousands of anglers each year. The March 1 opening on a portion of HWMA is very popular with anglers. Hagerman State Fish Hatchery stocks an average of 51,000 catchable Rainbow Trout annually on HWMA. Since 1940, the series of ponds have been developed with dikes and dams to provide habitat for fish and wildlife and to create recreational opportunities. Water and wetland vegetation constitutes about 163 ac. of the total area.

The aquatic habitat is suitable for both coldwater and warmwater fish species depending on spring inflow and distance from spring heads. The ponds are shallow with mean depths of approximately 1 meter and maximum depths of 2.0-2.5 meters. All ponds are characterized by extensive detritus (muck, decaying organic matter) bottoms which, during the summer, support extensive algae growth. Overhanging vegetation is present around all ponds where trees and shrubs are abundant.

Historically the Hagerman Wildlife Management Area provided some of the best Largemouth Bass and Bluegill fishing opportunities in the Magic Valley region. The Oster Ponds provided fishing opportunity for bass and Bluegill with anglers fishing from both the bank and float tubes. In the mid to late 1990s, the expanding Common Carp population began to deteriorate the warmwater fishing quality throughout the HWMA pond complex.

Common Carp are native to Asia and are known to alter water quality, reduce primary productivity, and severely impact warmwater fisheries (American Fisheries Society 1987). They compete heavily for food as well as habitat. They are fast growing and can produce millions of offspring. Once carp become established in a fishery, they are extremely difficult to control. In 2011, IDFG started a multifaceted approach to understand the fishery dynamics on the HWMA. This included an angler creel survey for comparison to the 1980s survey and inventorying water structures and water movement, as well as estimating carp distribution and abundance throughout the HWMA.

Creel census results indicated the angler use of the HWMA fisheries had significantly declined from 23,958 hours of angling effort in 1984 (Grunder 1986) to 4,661 hrs during the same period in 2011 (Stanton et al. 2020). We concluded use had declined in large part due to the lost productivity associated with the occurrence and abundance of carp.

The Department determined carp were present and relatively abundant in all but three ponds (Bass Ponds and the Goose Pond) on the HWMA. Carp presence was determined visually or by physically sampling the fisheries. We used electrofishing and trap net techniques to sample the fisheries and to attempt to estimate carp abundance using a modified Lincoln mark-recapture estimator. We estimated carp abundance in Anderson ponds 2 (estimate) and 4 (estimate), but were not able to complete an estimate on Anderson 1 due to the lack of recaptures. The Department determined that most of the resident fisheries would benefit if carp were either removed or their numbers were significantly reduced.

To accomplish this goal, we considered management options ranging from no action to complete renovation. Complete renovation was the most costly and resource-intensive options. However, this also had the greatest likelihood of longterm success to restoring the warmwater fishery. In 2014, IDFG chemically removed carp from Anderson Pond 4 and West highway pond using rotenone.

The goal of this effort is to improve the sport fish fishing opportunity on the HWMA and increase anglers use to levels that would match or exceed those estimated in 1986 by (Grunder et. al 1986). In addition, we intend to work collaboratively with the HWMA manager to develop a long-term fishery management plan.

STUDY SITE

The HWMA is located in Gooding County, along Highway 30, south of the town of Hagerman, Idaho. HWMA is 356 hectares. The Anderson Ponds Complex resides within the HWMA. This report encompasses phase 3 of the overall fishery restoration plan which is denoted in white in Figure 9.

OBJECTIVE

The objective of this study was twofold: 1) renovate (eradicate carp) Anderson Pond 4, and West Hwy Pond, and 2) re-establish a Largemouth Bass/Bluegill fishery in Oster ponds 2-5.

METHODS

Rotenone Application

Prior to the application of rotenone, Largemouth Bass and Bluegill in the ponds were salvaged using electrofishing techniques and unbaited trap nets. The catch was transported and temporarily held in the Goose Pond on the HWMA located approximately 0.5 km from the area. These salvaged fish would later serve as a source for reintroduction following the rotenone application.

The West highway pond and Anderson Pond 3 and 4 complex was drawn down to maximize the efficiency of the treatment, to isolate the ponds (no outflow), and to reduce the amount of chemical needed. On July 13, 2014, all impoundment outflow structures downstream of the west highway pond were opened allowing the impoundments to deplete as far as was feasible based on outflow design. All inflow structures were either closed or nearly closed to minimize recharge. The ponds remained without inflow for 65 days prior to the application of rotenone to allow as much water as possible to drain or evaporate to minimize the volume of water to be treated (Figure 10). Additionally, the drawdown isolated the remaining fish from the complex cover associated with the shorelines and concentrated them in shallow pools which would simplify the actual treatment and increase the probability of eradicating the remaining carp.

We estimated the volume of each remaining pool to determine the quantity of rotenone product needed for an effective treatment. Pool volumes were estimated by determining the average width and depth of each remaining pool. We used a range finder and manually took depths from a jon boat, and pre-treatment volume estimates are found in Table 7.

The Department followed rotenone application guidelines as outlined in the Planning and Standard Operating Procedures for the Use of Rotenone in Fish Management (Finlayson et al. 2000). Prenfish™ Toxicant (5.0 % rotenone) was the product selected to complete the fishery restoration. We adhered to label prescribed mixing and application requirements. The ponds were treated at a label prescribed rate of 5 ppm described for use for carp in an organic rich environment. Fish toxicant was applied with backpack pesticide application sprayers, an ATV pesticide application setup (2.5 m boom) retrofitted for a boat, and by a shoreline based water pump (output of .0003 m^3/s) that drew from a shoreline-based tank of premixed rotenone solution. The shoreline based solution was delivered by boat and from the shore through approximately 100 m of garden hose.

Sentinel fish in cages were used to determine treatment effectiveness. Sentinel cages containing eight to ten Bluegill were deployed into both treatment locations. These cages were checked to confirm if the product was applied at a lethal concentration with success being confirmed if the fish within the cage expired. An additional cage was placed below the outlet of west highway pond, and at the outlet of Anderson pond 4 to determine if rotenone was escaping the pond and thus signal the need to start detoxification.

We began to reintroduce water into the West highway Pond complex after we confirmed a complete kill. The water was introduced slowly to dilute the treated water and facilitate oxidation of the rotenone product. Sentinel cages were used to determine when the rotenone degraded to where concentrations were no longer lethal. Sentinel cages containing live fish were placed in three locations approximately every three days and evaluated after 24 h. This testing continued until fish were documented to survive at least 24 h. We slowly introduced water to the system 15 days after the treatment was complete.

Warm Water Fishery Rebuild

We used methods outlined in Soderberg and Swistock (1995) to rebuild the warmwater fishery in the Oster Pond complex. This method of Largemouth Bass and Bluegill pond management was typically implemented on northern latitude farm ponds. The protocol for establishing a new Largemouth Bass/Bluegill fishery required Bluegill to be introduced first. Bluegill reintroduction into Oster Ponds 2,3,4,5, and 6 took place in September and October 2013. Bass at least one year older than the Bluegills were stocked in early spring 2014. In order to achieve a balanced fish population, research in northern latitude Pennsylvania bass/Bluegill ponds recommends a prescription of bass/Bluegill density ration of 25/100 per surface acre (Soderberg and Swistock 1995).

RESULTS

Rotenone Application

Approximately 385 Largemouth Bass and 7,900 Bluegill were captured and transported from the West Highway Pond and Anderson Pond 4 and released into the Goose Pond prior to the rotenone treatment. Total trapping effort included using 7 trap nets with total effort of 55 net-nights on West Highway Pond and Anderson Pond 4. In addition, we electrofished for 6 hrs in the West Highway pond. No lengths or weights were taken during salvage efforts to minimize handling stress.

The pre-rotenone drawdown was a successful approach toward maximizing treatment efficiency. The resulting standing pools were completely isolated from the connecting streams and no detoxification stations were activated during the treatment. The volume of water to be treated was substantially reduced and fish access to complex habitat was essentially eliminated.

Renovation of West Highway Pond and Anderson Pond 4 was conducted on August 18 and 27, 2014. Treatment was initiated at approximately 0900 h and completed by 1430 h that same day. We cumulatively applied 314 liters of product into the two impoundments (Table 7). Lethal concentrations were confirmed within 12 hours of initial application.

Detoxification was confirmed approximately 7 days after treatment. Fresh water was introduced into the pond complex approximately 15 days after treatment to further dilute any remaining rotenone and to refill the ponds to normal volume.

Warmwater Fishery Rebuild

We transferred a total of 1,650 Bluegill in Oster Ponds 2 – 5 during fall of 2013, with 412 Largemouth Bass the following spring (Table 8). Largemouth Bass reintroduction was completed in Oster Ponds throughout March and April 2014. Largemouth Bass were restocked at a rate of 25 bass per surface acre. Full pool surface acreage and prescribed stocking is described in Table 8. No mortality occurred during the transplant process.

DISCUSSION

Rotenone Application

We successfully eradicated Common Carp from these two ponds. All sentinel cages documented lethal toxicity, and no live fish were observed 1 day after the treatment. The application time to dispense all chemical lasted longer than planned because the jon boat sprayer took longer than anticipated to dispense product. Post-treatment carcasses were not salvaged. We visually evaluated the treated fisheries at two and three days after treatment. Very few carp bodies were found and we assumed most were scavenged quickly after the treatment.

Warmwater Fishery Rebuild

Full stocking density goals for Largemouth Bass were achieved in Oster Ponds 2, 3, 4, and 5. Densities of 25 adult bass (>3 yr old) were stocked per surface acre in each pond. Once Largemouth Bass and Bluegill become established in the fisheries, it will be critical to monitor the densities and size distribution to meet fishery objectives. Understanding the bass-crowded (high

Bluegill PSD) and the Bluegill-crowded (high bass PSD) pond biology will inform future management actions are necessary to provide the desired size and catch rates of bass and Bluegill. These ponds could be managed to provide either quality Largemouth Bass fishing, or quality Bluegill fishing, depending on the goals for the fishery.

RECOMMENDATIONS

1. Reintroduce the prescribed density of Bluegill in the West Hwy Pond in the spring of 2015, prior to the Bluegill spawn.

2. Monitor newly established Bluegill and Largemouth Bass populations. In three years, evaluate the predator/prey balance in Oster Ponds 2 - 6. Compare both fish species PSD and implement appropriate management.

3. Implement Phase 4 of the HWMA fishery restoration effort. Eradicate Common Carp from Riley Creek (from hatchery diversion to Riley Creek falls), Riley Pond, and Anderson Pond #3.

BIG WOOD RIVER FISH POPULATION ASSESSMENT

ABSTRACT

A standard stream survey was completed on the Big Wood River in 2014 in three reaches. Population estimates (95% CI) for all trout $\geq$ 200 mm were Lower Hailey Transect, 2,148 ± 227, Gimlet Transect, 938 ± 171, and Boulder transect 236 ± 28, respectively. We documented a Big Wood River Brown Trout density and population estimate for the first time in the 2014 sampling event in the Hailey reach. The Mountain Whitefish (≥ 100 mm) abundance was estimated at 299 ± 147 in the Lower Hailey reach. A population estimate for Mountain Whitefish could not be generated in the Gimlet and Boulder reaches due to insufficient recaptures.

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INTRODUCTION

The Big Wood River provides a popular fishery with angling opportunities for Rainbow Trout, Brown Trout *Salmo trutta*, and Mountain Whitefish *Prosopium williamsoni*. The Big Wood River has been managed as a trophy wild Rainbow Trout fishery from the Glendale Diversion upstream to its headwaters since 1977. Restrictive regulations were expanded in 1990 to increase the trophy quality of the Big Wood River fishery. The Big Wood River fishery is currently managed to provide more diverse fishing options. Three regulation combinations include sections with a slot limit (two trout limit with none between 305 mm and 406 mm allowed), catch-and-release, and general regulations. Hatchery supplementation is currently limited to the North Fork of the Big Wood River, Big Wood River upstream of the North Fork confluence, Warm Springs Creek, Magic Reservoir, and intermittently below Magic Reservoir in the Richfield Canal section. Hatchery trout stocking coincides with locations managed under general regulations, while the rest of the watershed is managed for wild trout.

The Beaver Creek fire in 2013 was a lightning-caused event that burned an estimated 114,900 acres of land west and north of the town of Hailey, ID. This fire burned many of the headwater tributaries on the west side of the Big Wood River watershed. Immediately after the fire was extinguished, the Burned Area Emergency Response Team assessed the effected tributaries to develop plans to reduce soil erosion and mudslides within the area. Anglers expressed concerns that post-fire habitat conditions may lead to diminished fish populations and reduced fish size.

STUDY SITE

The Big Wood River originates in the Smokey, Boulder, and Pioneer Mountain ranges of south central Idaho (Figure12). The river flows south-southwest from its origin to its confluence with the Little Wood River west of Gooding, Idaho, forming the Malad River. The Big Wood River is impounded by Magic Dam located west of State Highway 75, forming Magic Reservoir. Below Magic Reservoir, the river is used extensively for irrigation and is often dewatered seasonally with the entire discharge being diverted in the Richfield Canal.

OBJECTIVE

The objective of this survey was to monitor the abundance and size structure of wild trout generate trout density estimates in three Big Wood River transects. More specifically, this effort was made to address public concerns about the post-fire sediment impacts to the Big Wood River fishery downstream from Warm Springs. Results from this survey will be compared to recent surveys.

METHODS

The Big Wood River was sampled at three standard transects using a raft electrofishing setup (Appendix A and B) to evaluate trends in fish abundance and condition. Standard transects included lower Hailey, Gimlet, and Kendall Gulch (Boulder), defined by Thurow (1987). Sample locations are described in Stanton and Megargle (2014) and are presented in Appendix A. We estimated the trout population using a mark/recapture survey. The mark runs were conducted between September 9th and 11th, 2014 and recapture runs occurred seven days later between

September 16th and 18th, 2014. Survey methods and data analysis are described in Stanton and Megargle (2014). A description of equipment used in river and stream surveys is listed in Appendix B.

RESULTS

Lower Hailey Transect

Transect length and mean width at the lower Hailey transect was 1,058 m, and 19.2 m, respectively.

A total of 1,598 fish were caught in the Lower Hailey reach in both the mark and recapture runs. The catch in the lower Hailey transect included wild Rainbow Trout, Mountain Whitefish, Brook Trout, Brown Trout, sculpin *spp*., and sucker *spp*.

The Rainbow Trout (≥ 200 mm) population estimate (95% CI) was 1,912 ± 222, which equated to 718 trout/ha (Table 9). The mean TL of Rainbow Trout was 178 mm (± 4; 90% CI) and ranged from 42 - 420 mm (Figure 13). The Brown Trout (≥ 200 mm) population was estimate and associated density was 236 ± 57 and 16 trout/ha, respectively. The mean TL of Brown Trout was 229 mm (± 13) and ranged from 48 - 479 mm TL (Figure 14). The Mountain Whitefish (≥ 100 mm) population estimate was 299 ± 147. The mean TL of Mountain Whitefish was 228 (± 19) and ranged from 79 – 459 mm TL. (Figure15).

Gimlet Transect

The Gimlet transect length and mean width was 694 m and 18.4 m, respectively. A total of 931 total fish were caught in the Gimlet reach in both the mark and recapture runs. Fish sampled in the Gimlet transect included wild Rainbow Trout, Brown Trout, Brook Trout, Mountain Whitefish, and sculpin. The number of Rainbow Trout ≥ 200 mm was estimated at 938 ± 171, which is equal to 733 trout/ha (Table 9). The mean TL of Rainbow Trout was 189 mm (± 6) and ranged from 25 – 419 mm (Figure16). We did not have sufficient recaptured to estimate the Mountain Whitefish (≥ 100 mm) population. The mean TL of Mountain Whitefish was 255 mm (± 37) and ranged from 89 – 489 mm (Figure 17).

Kendall Gulch (Boulder) Transect

Transect length and mean width at the Boulder location was 982 m, and 12.5 m, respectively. A total of 440 trout were caught in the Boulder reach in both the mark and recapture runs combined. Fish sampled in the Boulder transect included Rainbow Trout, Mountain Whitefish, and sculpin. The number of Rainbow Trout ≥ 200 mm was estimated at 236 ± 28, which is equal to 193 trout/ha (Table 9). The mean TL of Rainbow Trout was 197 mm (± 11) and ranged from 39-479 mm TL (Figure 18).

The mean relative weight for trout (Simpkins et al. 1996) from all transects combined was 81 (SD = 20) (Figure 19).

DISCUSSION

The purpose of this survey was to address public concern that the post-fire habitat conditions of the Big Wood River has resulted in a decrease in the number of fish in the river and a decrease in the sizes of fish caught. Based on the population estimates from our three transects, it does not appear that the fire had a measureable impact to trout numbers. Overall, there appeared to be no substantial changes in Rainbow Trout densities when compared to the 2009 and 2012 surveys (Table 9). While 95% CI indicate moderate variation, the point estimates suggest fish numbers actually increased relative to 2012 in the Lower Hailey and Boulder transects.

While total fish numbers appear to be stable, there was a substantial decrease in fish condition as measure by W_r. This 20% decrease in fish condition may be indicative of stress associated with post-fire declines in water quality, food availability or habitat conditions. We speculate that this is likely only a temporary downward shift in fish condition, which should improve as the river begins to mobilize fire-related sediments and habitat conditions improve over the next several years.

We did not document a change in the size range of Rainbow Trout in the Gimlet and Hailey reaches. Figures 13 and 16 compare the length frequency histograms of the catch in these reached in 2012 and 2014. Of note is the similar range of rainbow trout sizes in the catch and the apparent decrease in the relative abundance of YOY. We do not target YOY due to their small sizes, but the YOY are typically caught incidentally while targeting fish over 120 mm. The large influx of post-fire sediment entering the Big Wood River could have reduced YOY production or survival. Fine sediment and ash may have reduced spawning gravel quality and egg-to-fry survival in 2014, reducing the densities of YOY during our fall sampling. Theoretically, these two samples should be comparable, but caution should be observed when drawing conclusions. We could substantiate this claim if the apparent weak YOY cohort is documented again in subsequent population surveys when they grow to sizes we are more efficient at sampling.

The post-fire conditions seem to have negatively impacted mean relative weight and possibly the 2014 Rainbow Trout year class. We can’t conclude there was a complete recruitment failure related to post-fire habitat impacts, but it appears as though recruitment has declined. The fishery is schedule to be sampled again in 2018. We may wish to sample prior to that year to determine if recruitment has indeed declined, and whether there was any effect on the wild trout population that could impact angling.

Of note is the fact that this was the first year we were able to estimate Brown Trout abundance. In most years, they were sampled in such low numbers that recaptures were unlikely and uncommon. This estimate was made in the Lower Hailey Reach where Brown Trout are likely beginning to establish themselves in greater numbers. Continuation of the triennial surveys on the Big Wood River to monitor trends in relative abundance of all species will be important to identify shifts in species composition through time. Brown Trout provide another opportunity for wild trout production within the system.

RECOMMENDATIONS

1. Continue triennial surveys on the Big Wood River to monitor relative abundance, YOY recruitment, and species composition within the trend sites.

2. Continue to monitor relative weights across all trend sites to better understand whether post-fire stress mechanisms, such as decreased water quality, food availability, or habitat conditions, continue to act upon the Rainbow Trout population.

FIGURES

Figure 1. Satellite image of Anderson Ranch Reservoir, (Google Earth). Top of map is north.

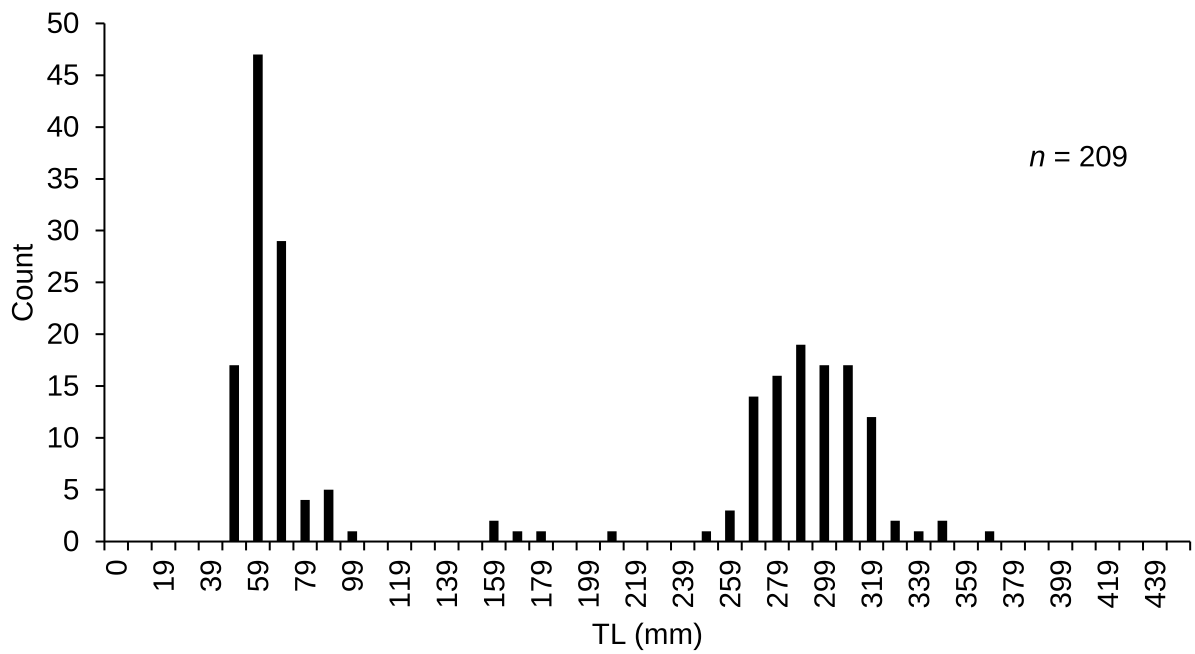

Figure 2. Length-frequency histogram for kokanee sampled using a trawl in Anderson Ranch Reservoir in 2014.

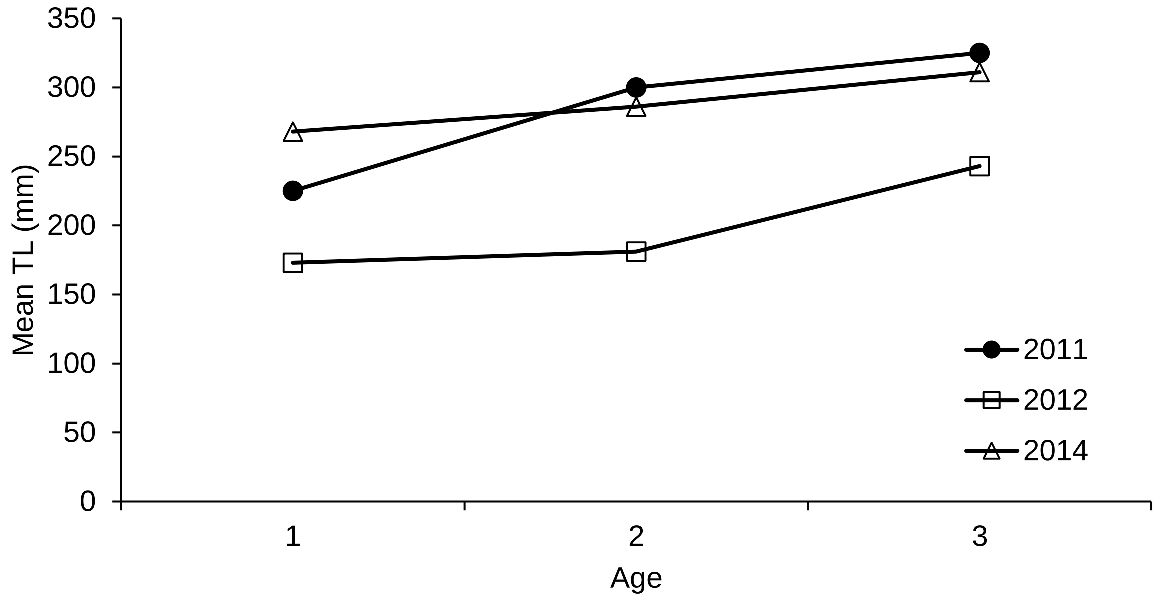

Figure 3. Mean length at age for trawl-caught kokanee in Anderson Ranch Reservoir by year. Sample sizes by year are: 2011 (*n* = 97), 2012 (*n* = 158), and 2014 (*n* =110).

Figure 4. Satellite image of Bruneau Dunes Ponds, (Google Earth). Top of map is north.

Figure 5. Satellite image of Carey Lake Wildlife Management Area (Google Earth). Top of map is north.

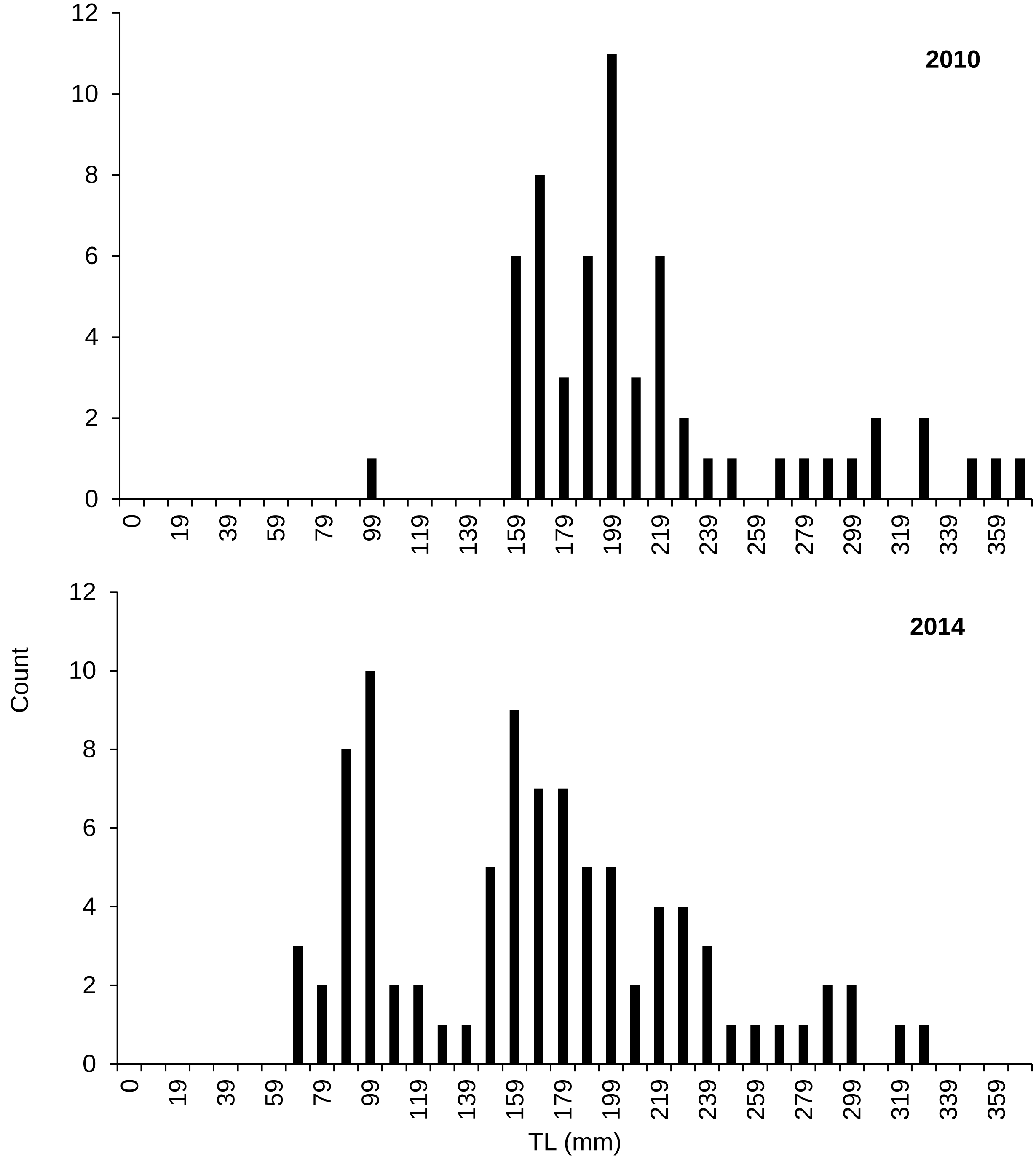

Figure 6. Length-frequency histograms for Largemouth Bass collected on Carey lake in 2010 (n = 56) and 2014 (n = 55) via electrofishing.

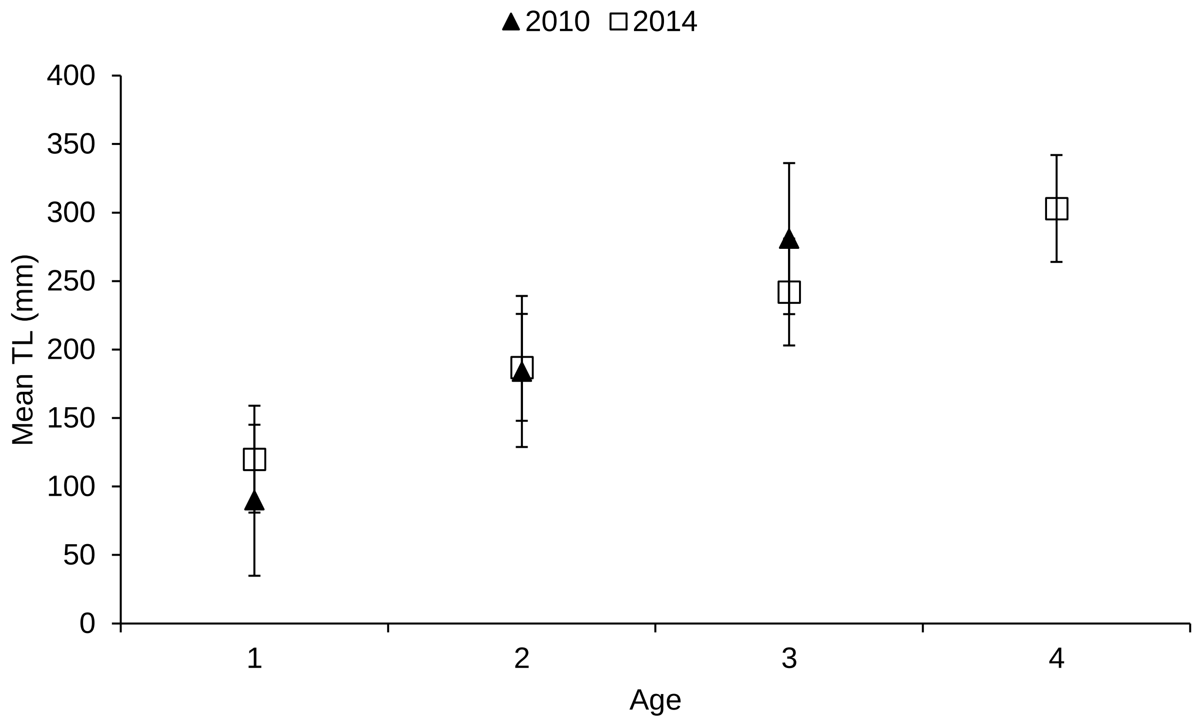

Figure 7. Mean Length at age of Largemouth Bass from Carey Lake collected in 2010 (*n* = 60), and 2014 (*n* = 47), via electrofishing.

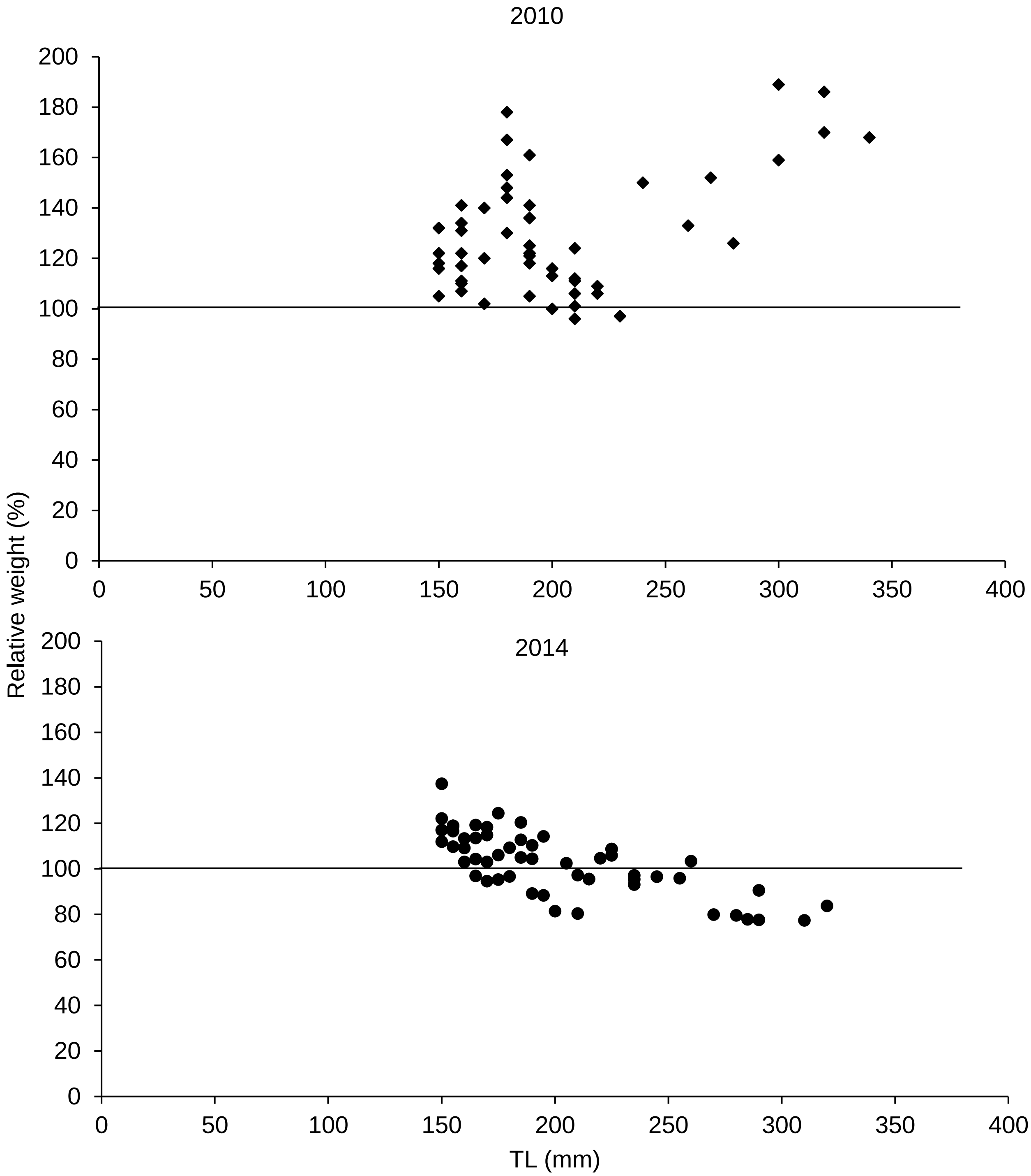

Figure 8. Relative weight comparisons for Largemouth Bass collected on Carey Lake in 2010 (*n* = 56), and 2014 (*n* = 55), via electrofishing.

Figure 9. Satellite image of Hagerman Wildlife Management Area, (Google Earth). Top of map is north.

Figure 10. Post draw-down pools in West Highway pond, Anderson Ponds 3, 4, and Riley Pond. Areas circled in white indicate isolated pools of water intended to be treated with piscicide. Top of map is north.

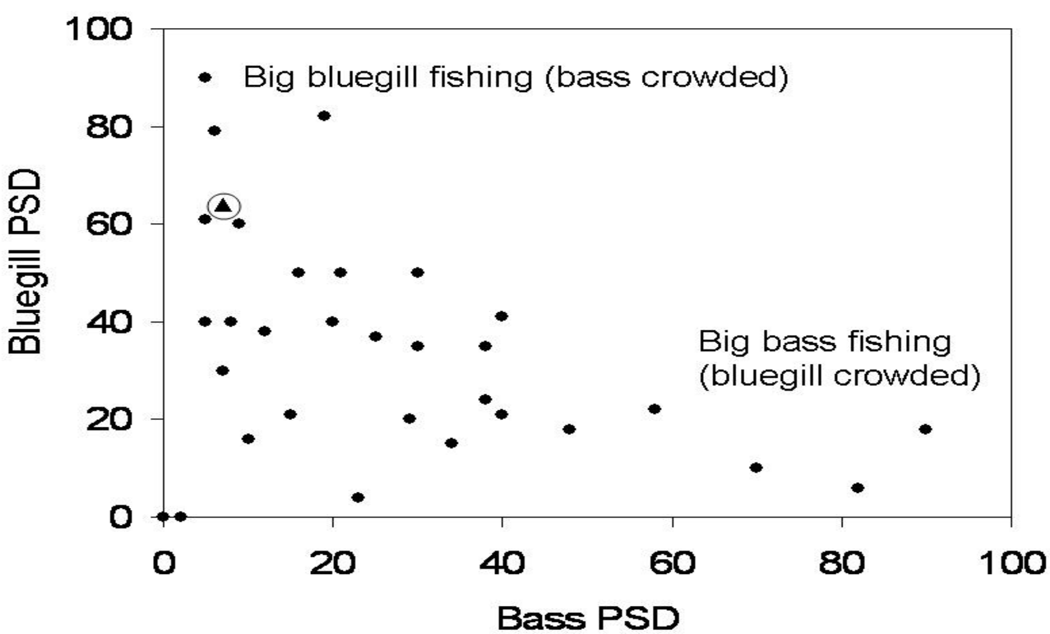

Figure 11. Plot of Bluegill PSD versus bass PSD for many ponds in northern Pennsylvania. each dot represents a separate pond (Soderberg et al 1995.).

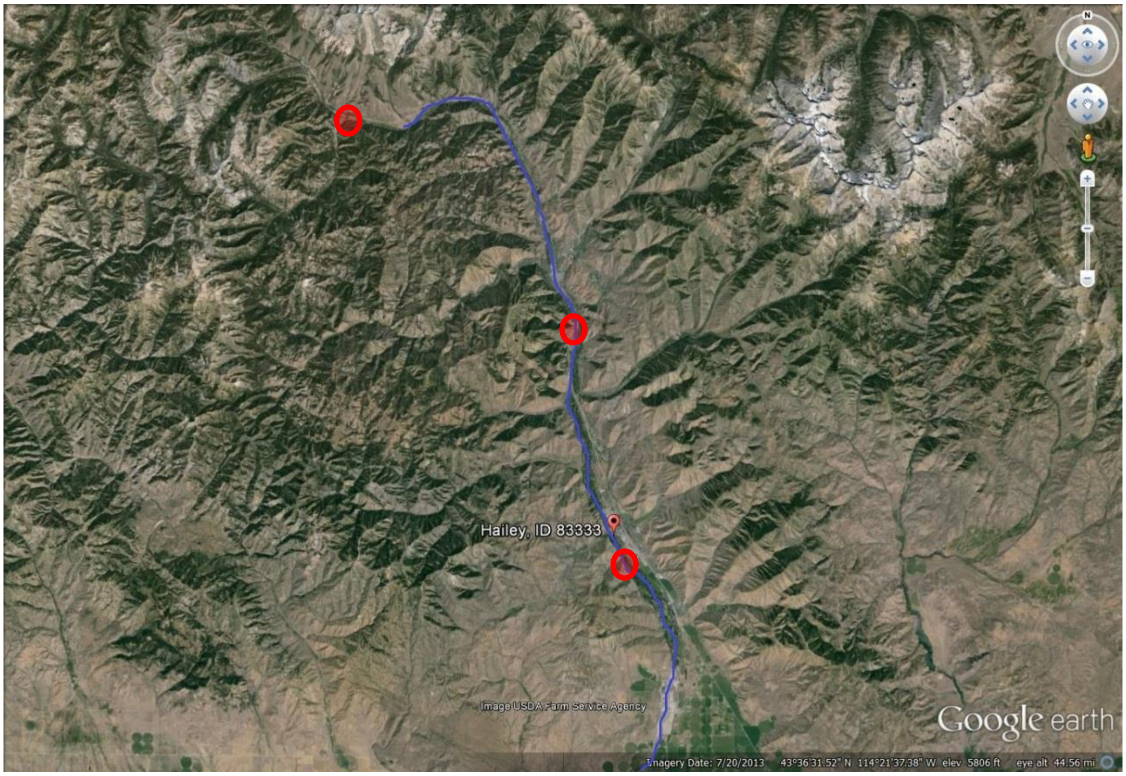

Figure 12. Satellite image of the Big Wood River,(Google Earth), top of image is north. Red circles mark sampling areas: top = Boulder, middle = Gimlett; bottom = Hailey.

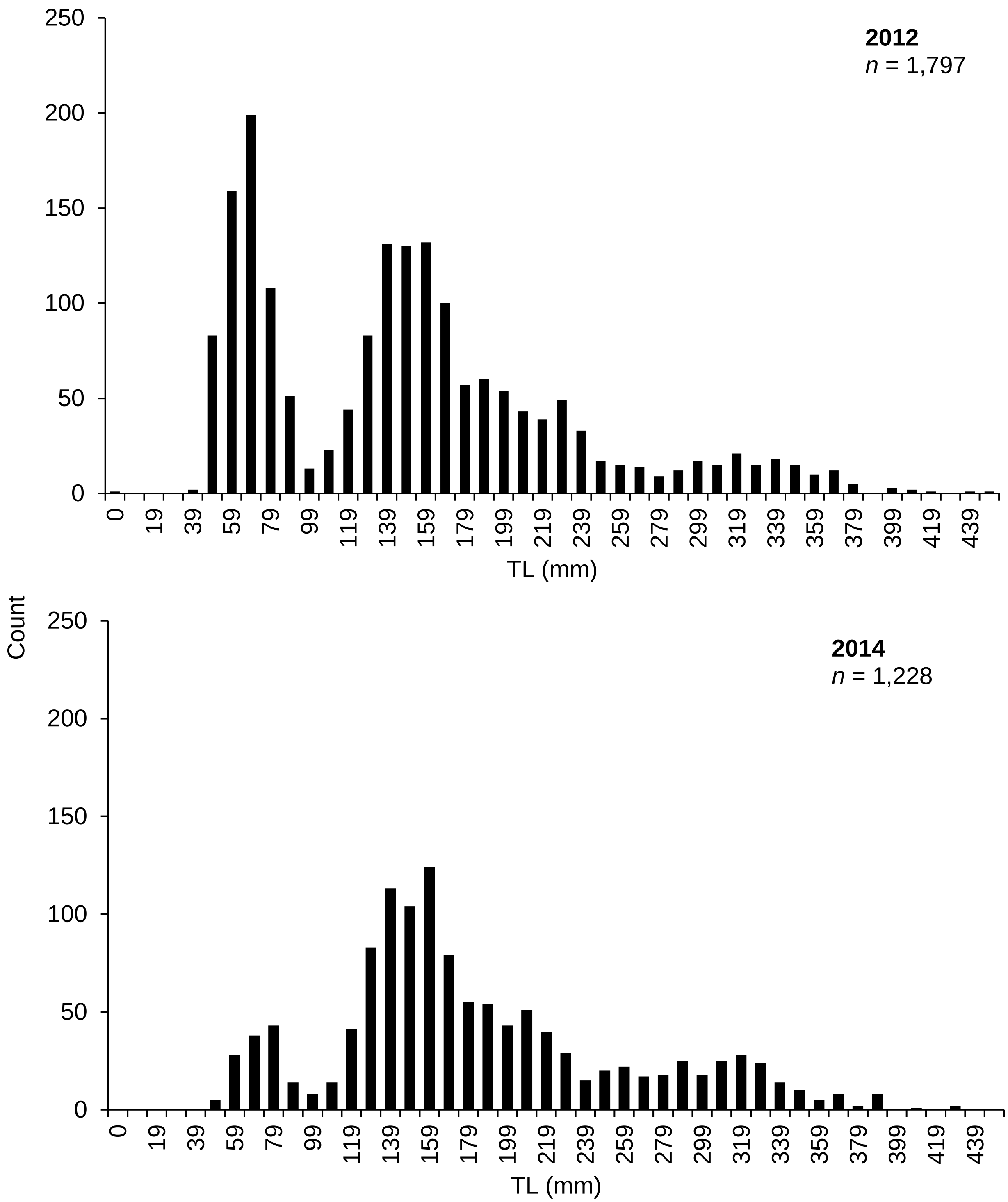

Figure 13. Length-frequency histogram for Rainbow Trout collected in the Lower Hailey reach of the Big Wood River in 2012 (top) and 2014 (bottom).

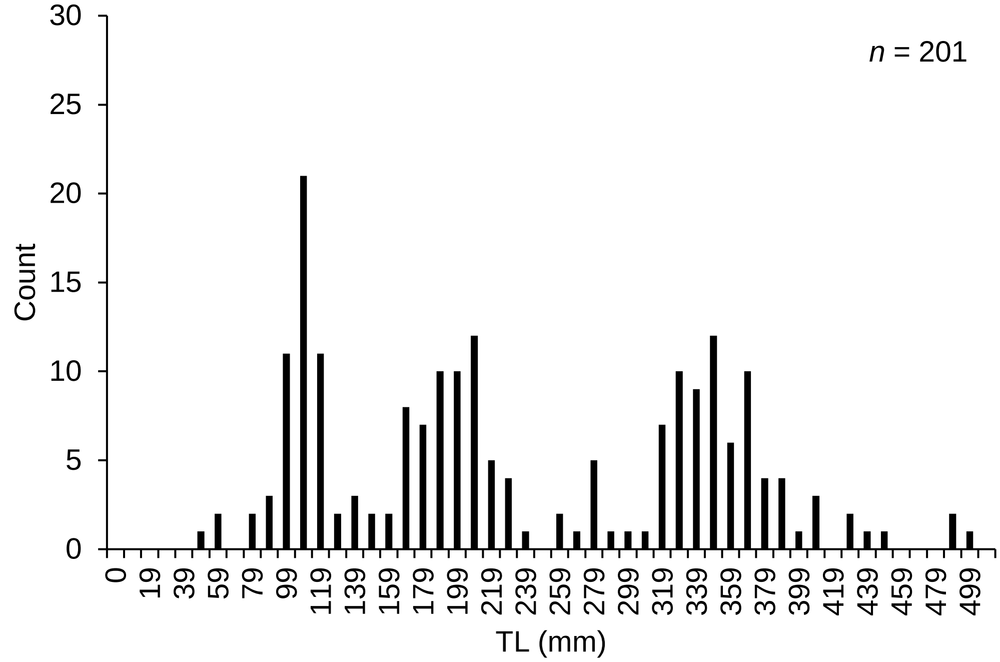

Figure 14. Length-frequency histogram for Brown Trout collected in the Lower Hailey reach of the Big Wood River in 2014.

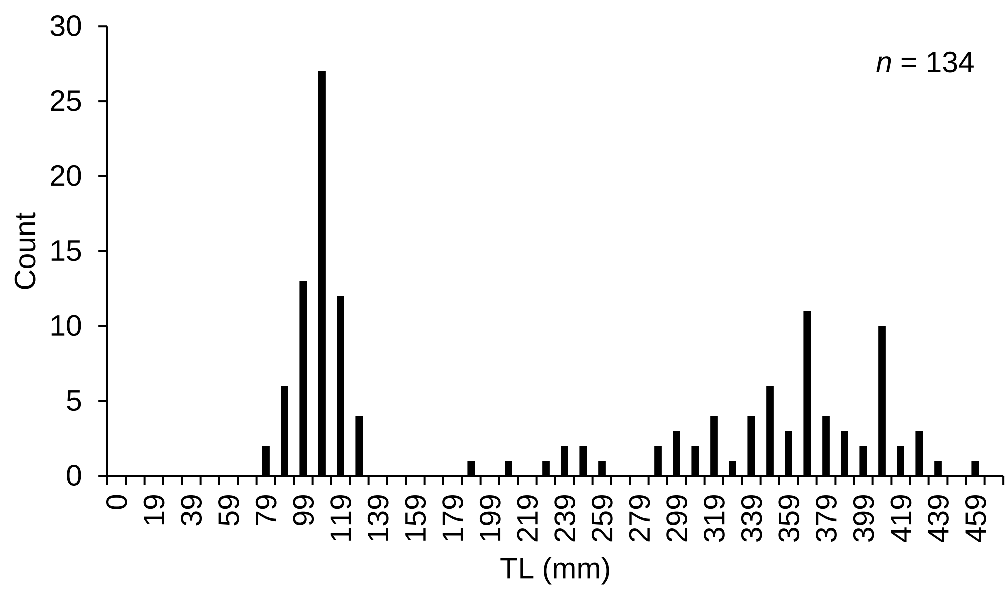

Figure 15. Length-frequency histogram for Mountain Whitefish collected in the Lower Hailey reach of the Big Wood River in 2014.

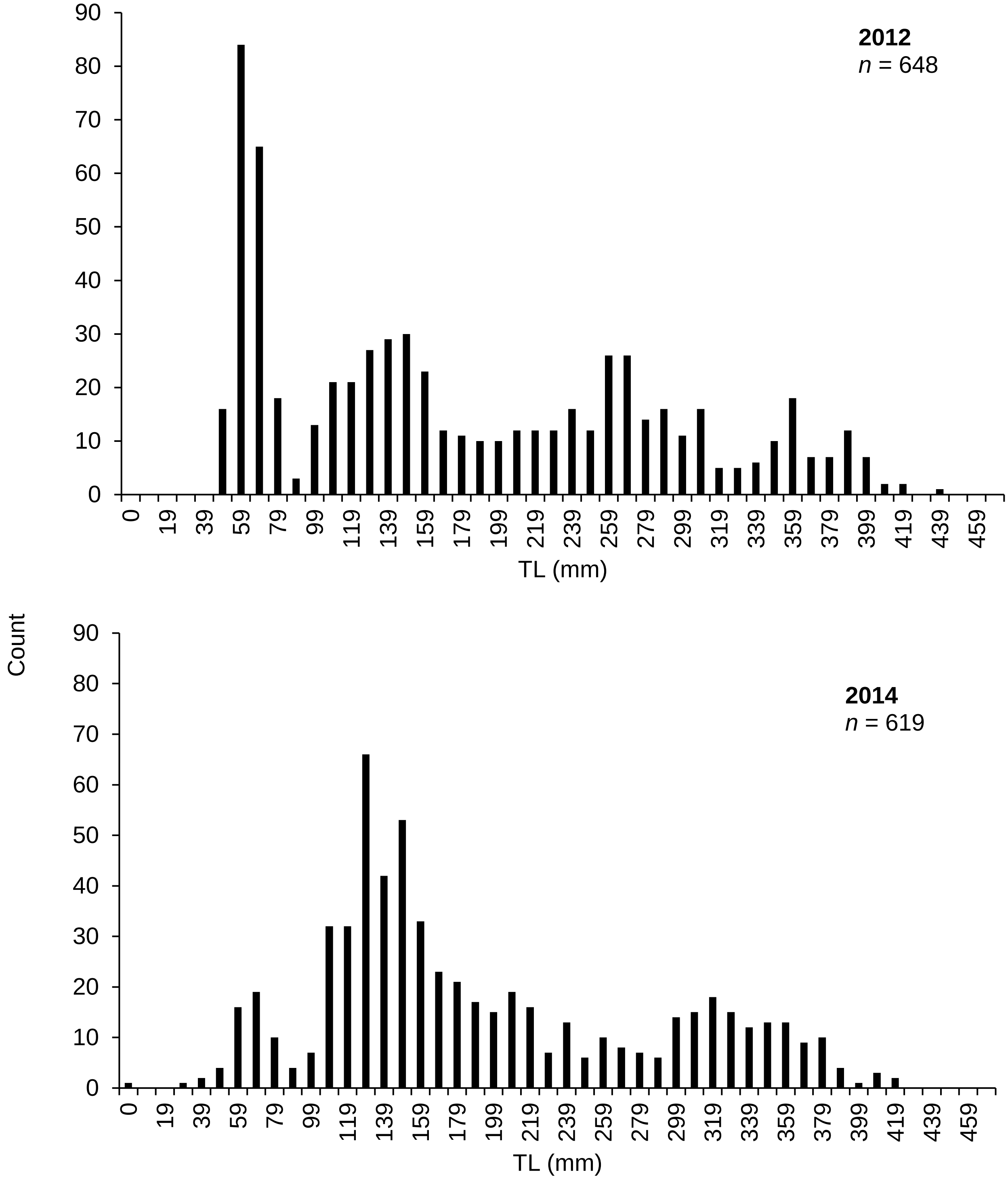

Figure 16. Length-frequency histogram for Rainbow Trout collected in the Gimlet reach of the Big Wood River in 2012 (top) and 2014 (bottom).

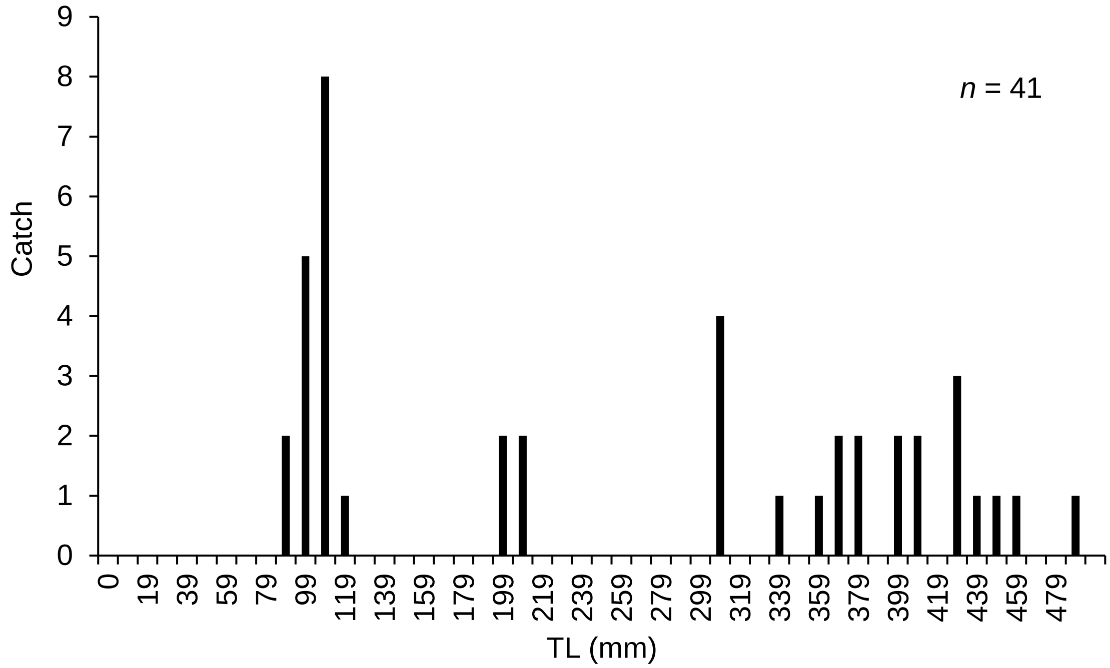

Figure 17. Length-frequency histogram for Mountain Whitefish collected in the Gimlet reach of the Big Wood River in 2014.

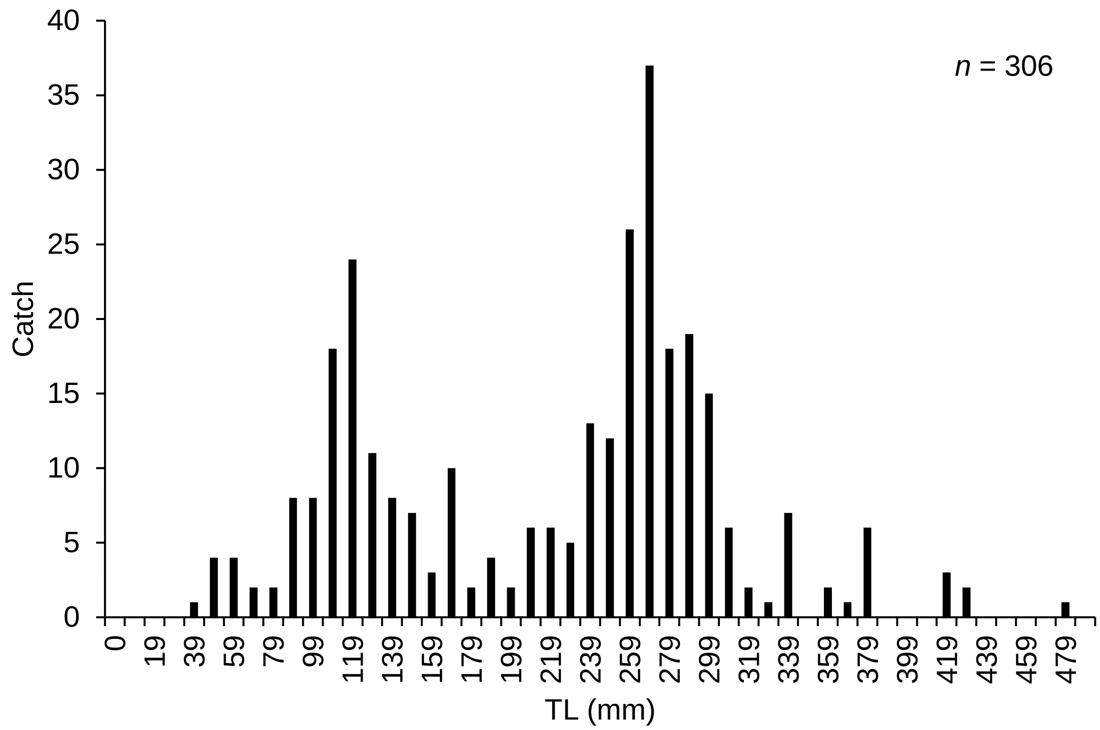

Figure 18. Length-frequency histogram for Rainbow Trout collected in the Boulder reach of the Big Wood River in 2014.

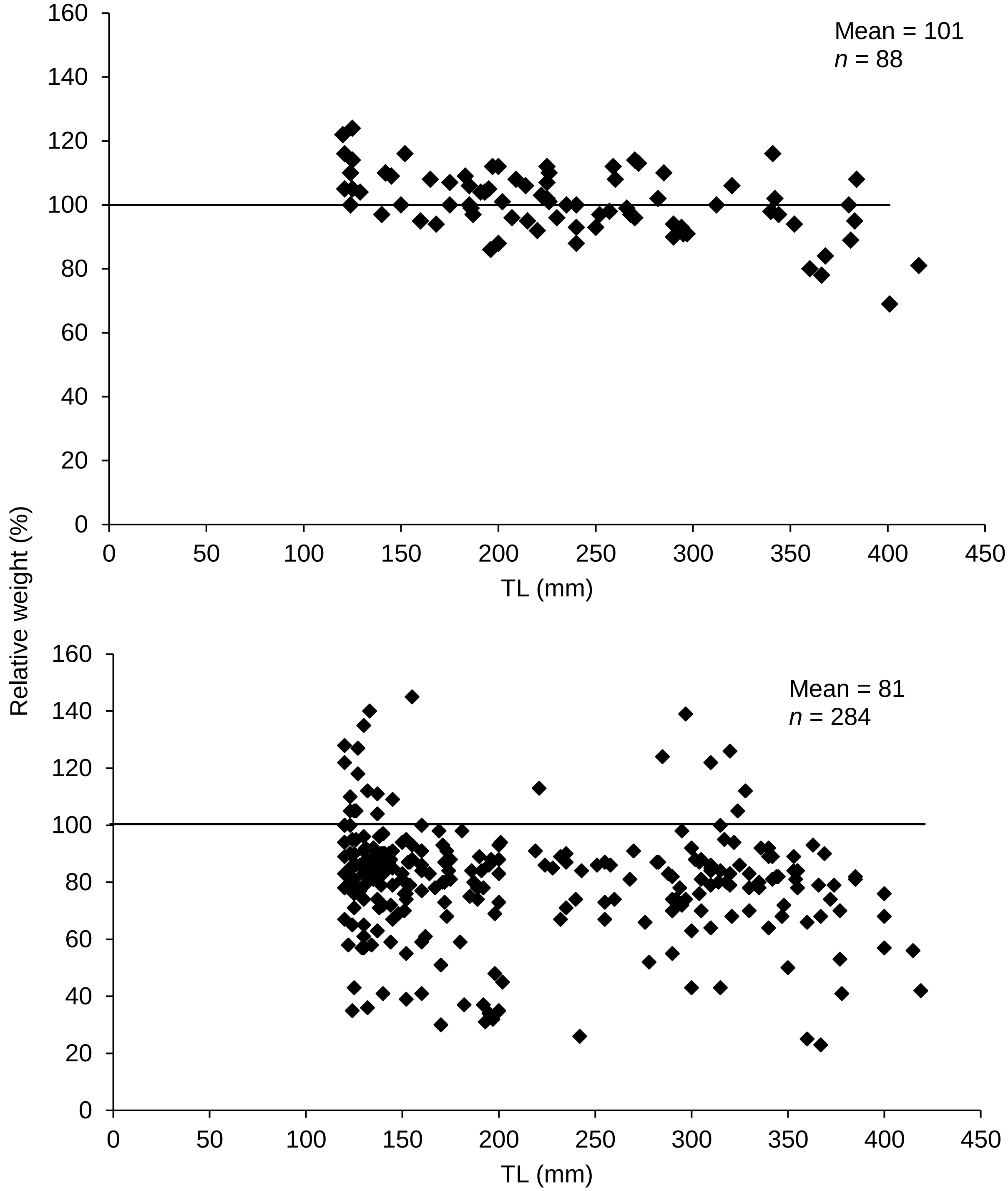

Figure 19. Relative weight expressed as percent for a subsample of Rainbow Trout, collected from the Big Wood river in 2012 (top) and 2014 (bottom). Solid line depicts normal based on national standards.

TABLES

Table 1. Whole-lake population estimates for kokanee in Anderson Ranch Reservoir based on trawling during July 23-24, 2014.

			Population estimates by section				
Section	Age-0	Age-1	Age-2	Age-3	Age-4	Age-5	Total
Sec. 1	40,290	0	9,555	1,881	0	0	
Sec. 2	22,571	9,958	53,501	7,850	0	0	
Sec. 3	46,856	5,582	40,171	5,240	0	0	
Whole-lake est.	109,717	15,540	103,228	14,970	0	0	243,454
95% CI	42,633	7,296	25,574	6,051	0	0	
95% CI as %	39%	46.95%	24.77%	40.42%	0%	0%	
Fish/ha	75.7	10.7	71.2	10.3	0	0	167.9
n =	21						
N_t =	24,572						
t-value =	2.086						
Area (ha) =	1,450						
			Biomass estimates (kg)				
	Age-0	Age-1	Age-2	Age-3	Age-4	Age-5	Total
Sec. 1	57	0	2,479	535	0	0	3,071
Sec. 2	25	1,388	13,040	2,388	0	0	16,841
Sec. 3	72	766	8,962	1,337	0	0	11,137
Whole-lake est.	154	2,154	24,482	4,260	0	0	31,050
			Standing crop estimates (kg/ha)				
	Age-0	Age-1	Age-2	Age-3	Age-4	Age-5	Total
Sec. 1	0.2	0	7.8	1.7	0	0	9.6
Sec. 2	0.05	2.5	23.7	4.3	0	0	30.6
Sec. 3	0.1	1.3	15.5	2.3	0	0	19.2
Whole-lake est.	0.1	1.5	16.9	2.9	0	0	21.4

Table 2. Anderson Ranch Reservoir Kokanee abundance estimates for the years 2003-2014.

Year	Age-0	Age-1	Age-2	Age-3
2003	166,214	9,062	3,790	1,091
2004	-	-	-	-
2005	526,307	37,980	12,736	20,652
2006	1,186,580	192,890	40,528	9,827
2007	692,704	841,421	97,832	66,645
2008	1,172,086	40,712	152,748	30,584
2009	431,627	57,410	15,021	10,134
2010	786,879	45,215	137,352	44,507
2011	2,632,168	108,117	28,146	12,319
2012	6,357,038	1,199,423	111,074	4,203
2013	-	-	-	-
2014	109,717	15,540	103,228	14,970

Table 3. Estimated angler effort with 95% CI in Bruneau Dunes Pond #1 (smaller upper pond) in 2014 by month. Estimates were generated using an average of 12 daylight hours per day.

Effort	May	June	July
Estimated effort	1,650	1,180	347
Lower CI	799	450	30
Upper CI	2,500	1,912	663

Table 4. Estimated angler catch, 95% CI and catch rate (fish/h) from May 6 to October 31, 2014 in Bruneau Dunes Pond #1 (smaller upper pond).

	Catch		
Month	Est (#)	CI	Rate (fish/h)
May	9,489	1,400-17,578	5.8
June	6,837	2,337-11,337	5.8
July	660	614-706	1.9

Table 5. Estimated angler effort with 95% CI in Bruneau Dunes Pond #2 (lower large pond). Estimates were generated using an average of 12 daylight hours per day.

Effort	May	June	July
Estimated effort (E)	106	230	146
Lower CI	78	30	52
Upper CI	290	490	252

Table 6. Standard Largemouth Bass sampling indices among Magic Valley Region fisheries 2007-2014.

			Year							
Fishery	Species	Measure	2007	2008	2009	2010	2011	2012	2013	2014
Carey L.	LMB	Ave. catch (CPUE)	84			34				80
		Ave. length (mm)	156			205				162
		Ave length at Age-5								
		PSD	7			22				18
		RSD(S-Q)	93			71				90
		Max. age (years)	3			3				4
Bell Rapids Res.	LMB	Ave. catch (CPUE)		7	12				7	
		Ave. length (mm)		244	277				226	
		Ave length at Age-5		302	325				375	
		PSD		33	56				55	
		RSD(S-Q)		67	44				45	
		Max. age (years)		10	10				6	
Dierkes L.	LMB	Ave. catch (CPUE)					31			
		Ave. length (mm)					249			
		Ave length at Age-5					260			
		PSD					12			
		RSD(S-Q)					88			
		Max. age (years)					10			

Table 7. Rotenone application table for West Highway Pond and Anderson Pond 4 treatment in 2014.Volume refers to total L of 5.0% active rotenone solution dispensed during treatment. Treatment concentration was 5 ppm and 0.25 ppm active rotenone.

Water body	Pool ID	Avg. width (m)	Avg. length (m)	Avg. depth (m)	Area (ha)	Volume (L)
West Hwy Pond	Pool #1	103	1,133	1.8	16	261
Anderson Pond 4	Pool #1	100	760	1.2	1	19
	Pool #2	89	210	1.2	0.8	34
				Total	17.8	314

Table 8. Area in hectares (ha) of each restored fishery at full pool volume, along with the count of Bluegill (BGL) and Largemouth Bass (LMB) restocked in the fishery.

		Restocked	
Fishery	Ha	BGL	LMB
Oster Lake 2	1.7	420	105
Oster Lake 3	2.1	540	135
Oster Lake 4	2.2	550	137
Oster Lake 5	0.6	140	35

Table 9. Densities of Rainbow Trout ≥ 200 mm by year and location in the Big Wood River.

Reach	Year	Season	Pop. est.	95% CI	Trout/ha
Lower Hailey	1986	Summer	352	218-598	97
	1987	Summer	544	292-1,113	177
	1988	Summer	1,038	749-1,483	353
	1992	Fall	974	834-1,114	331
	1995	Fall	979	789-1,170	263
	1996	Fall	1,351	1,168-1,534	386
	2000	Fall	1,237	1,082-1,392	488
	2003	Fall	701	413-989	334
	2006	Fall	1,327	951-1703	566
	2009	Fall	959	481 -1437	470
	2012	Fall	1,029	685 -1237	386
	2014	Fall	1,912	1,690-2,134	718
Gimlet	1986	Summer	675	431-1,898	197
	1987	Summer	955	609-1,577	318
	1988	Summer	808	601-1,111	276
	1992	Fall	895	713-1,077	406
	1993	Fall	1,001	770-1,232	326
	1995	Fall	985	835-1,135	343
	1996	Fall	1,280	1,120-1,440	410
	2000	Fall	1,123	978-1,268	744
	2003	Fall	744	545-943	392
	2006	Fall	1,198	971-1417	856
	2009	Fall	1,166	743-1409	810
	2012	Fall	1,003	873-1,287	793
	2014	Fall	938	767-1,109	733
Boulder	1986	Summer	43	19-108	32
	1987	Summer	20	10-40	-
	1996	Fall	27	22-32	19
	2006	Fall	157	134-184	150
	2009	Fall	160	97-223	131
	2014	Fall	236	208-264	193

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APPENDICES

APPENDIX A. Survey Locations

Water	Site #	Gear [a]	Time (h:min)	E	N	Zone	Datum	Note
And. Ranch Res.	1	Trawl		626547	480154	11	WGS84	Kokanee
Big Wood River	1	E-fish		701628	485038	11	WGS 84	Strm. surv.
	2	E-fish		702054	485073	11	WGS84	Strm.surv.
	3	E-fish		713877	483470	11	WGS84	Strm.surv.
Bruneau Dunes P.	1							
Small Pond				456988	467561	11	WGS84	Creel
Large Pond	2			708331	487625	11	WGS84	Creel
Carey Lake	1	E-fish	0.15	262605	480180	11	WGS84	LMB Eval.
	2	E-fish	0.15	262681	480185	11	WGS84	
	3	E-fish	0.15	262854	480173	11	WGS84	LMB Eval.
	4	E-fish	0.15	262875	4801648	11	WGS84	LMB Eval.
	5	E-fish	0.15	263134	4801791	11	WGS84	LMB Eval.
HWMA								
West Pond	1			673561	467371	11	WGS84	Rotenone
Anderson P. #4	1			684532	466504	11	WGS84	Rotenone

[a] E-fish: stream electrofishing setup, BEFISH: boat electrofishing setup, SKGNET: sinking gill net, FGNET: floating gill net, THERMO: continuous water temperature loggings, FWIN GILL NEW: unique multi-pannel gill net used to sample walleye..

APPENDIX B. Equipment Specifications

Fishery type	Equipment	Description
	25 gallon Boom Sprayer	Rotenone application with 12 Crestliner Johnboat
	Scale	Pesola ©: , 0-300 g, 0-1 kg, 0-2.5 kg scales
	Conductivity meter	Yellow Springs Instrument (YSI) model 30
	Depth sounder	Hondex© portable depth sounder
	Secci disc	Standard; decimeter graduation
	pH meter	Oakton © hand held pH meter - Model 35624.2
	Power boat electrofisher	Smith-root © model SR-18 w/ model 5.0 pulsator
Lakes & res.	Boom	Aluminum (2.6 m-long)
	Anode	Octopus-style steel danglers (1 m-long)
	Cathode	Boat and cathode array danglers - simultaneous
	Live well	Fresh flow aerated; 0.65 m^3
	Oxygen stone	35.6 X 3.8 cm (135 m^2); fine pore
	Generator	Honda © ; model EG5000x; 5,000 watt
	Electrofishing control box	Coffelt © ; model 15 VVP
	Sinking gillnet	6 panels (19, 25, 32, 38, 51, 64 mm bar-mesh); 38 x 1.8 m; monofilament
	Floating gillnet	6 panels (19, 25, 32, 38, 51, 64 mm bar-mesh); 38 x 1.8 m; monofilament
	Walleye Gillnet (FWIN)	8 panel (25, 38, 51, 64, 76, 102, 127, 152 mm bar-mesh); 61 x 1.8 m, monofilament
	Trap net	1.8 x 0.9 m box, 5 - 76 cm hoops, 15.2 m lead, 2 cm bar mesh
	Seine	18 m x 1 m, 6 mm mesh 18 m x 1 m, 3 mm mesh
	Conductivity meter	Yellow Springs Instruments © (YSI); model 30
	Plankton nets	250, 500, 750 *u* mesh; 0.5 m diameter mouth; 2.5 m depth
	Temperature / D.O. meter	Yellow Springs Instruments © (YSI); model 550A
	Dip nets	2.4 m-long handles ; trapezoid heads (0.6 m^2); 9.5 mm bar-mesh
	Secci disc	Standard; decimeter graduation

Fishery type	Equipment	Description
	Thermograph	Onset-Tidbit© v2 temp logger.
	Field PDA	Juniper Systems ©, model Allegro handheld; waterproof, WinCE/DOS compatible
	Scales	AND© 5000g electronic, OHAUS© 3000g, electronic Pesola © : , 300 g, 1 kg, 2.5 kg, 5.0 kg scales
	Power boat electrofisher	Smith-root © model SR-18 w/ model 5.0 pulsator - see above for specs.
	Raft	4.9 m-long rubber
Rivers and streams	Anode	13.7 m-long power cord; 2.4 m-long fiberglass handle; 0.4 m diameter steel hoop
	Cathode	Boat
	Live well	208 L plastic garbage can; O_2 supplemented
	Drift boat	4.5 m-long aluminum
	Boom	4.3 m-long fiberglass
	Anode	Octopus-style steel danglers (1 m-long)
	Cathode	Boat
	Live well	208 L rubber stock watering tub; O_2 supplemented
	Scales	AND© 5000g,electronic, OHAUS© 3000g,electronic Pesola © : , 300 g, 1 kg, 2.5 kg, 5.0 kg scales
	Oxygen stone	35.6 X 3.8 cm (135 m^2); fine pore
	Generator	Honda © ; model EG5000x; 5,000 watt
	Electrofishing control box	Midwest lakes ©
	Oxygen stone	35.6 X 3.8 cm (135 m^2); fine pore
	Dip nets	2.4 m-long handles ; trapezoid heads (0.6 m^2); 9.5 mm bar-mesh
	Backpack electrofisher	Smith-root © model 15-D; single anode
	Conductivity meter	Yellow Springs Instrument © (YSI) model 30
	Thermograph	Onset-Tidbit© v2 temp logger.

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